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Avena strigosa — a disappearing synanthropic species in Czechoslovakia

***Avena strigosa* — mizející synantropní druh v Československu**

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A survey is given of the taxonomic problems, geographical distribution, man's role in spreading, and historical aspects of *Avena strigosa* Schreb. s. ampl. The distribution of *A. strigosa* Schreb. s. str. in Czechoslovakia is shown in a cartogram backed by the list of localities. *A. strigosa* is an old ergasiolipophyte (sensu Thellung) which was cultivated in Czechoslovak territory in the past and became here also a weed. However, its present occurrence is quite limited and the species is practically on the verge of extinction.

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INTRODUCTION

The genus *Avena* L. is represented in the Flora of Czechoslovakia (Dostál et al. 1950 : 2017—2020) by five species, of which *A. sativa* L. is known as a cultivated plant and *A. fatua* L. is a widely distributed weed, whereas *A. nuda* (L.) Hoejer and *A. sterilis* L. are noted as casual aliens only. *A. strigosa* Schreb. is there characterized by the words "native in western Europe", and "in the past frequently cultivated in mountainous regions, at present a weed plant in western and south-western Moravia and in Silesia only" (Dostál et al., l.c.). The latter statement was probably based on earlier floras and floristic contributions published e.g. by Čelakovský (1868, 1883, 1888, 1889, 1891), Oborny (1883), Formánek (1887), Laus (1908), Podpěra (1925), and perhaps by others. The present situation has markedly changed, and *A. strigosa* does not play any role either as a cultivated plant or as a weed. Nevertheless, it is an interesting synanthropic plant, an ergasiolipophyte sensu Thellung (in Naegeli et Thellung 1905 : 233), for which suitable conditions of subspontaneous spreading have evidently ceased to exist in Czechoslovakia. This fact of itself is quite interesting from the viewpoint of various types and stages of naturalization of introduced plants. In general, it is well known that some synanthropic plants are extending, while others are diminishing their areas (cf. e.g. Salisbury 1961), however, the bio-ecological mechanism of this phenomenon has not so far been thoroughly studied. Another species, *Avena fatua*, when compared with *A. strigosa*, is very well naturalized on arable land in Czechoslovakia, and continues to spread (Kropáč 1980). *A. strigosa* should, however, also evoke our interest from the viewpoint of the threatened taxa of the flora of Czech Socialist Republic (Holub et al. 1979); it was not included in this first draft of the "Red list" of plants — perhaps owing to its supposed sowings.

As to the morphological characters, *A. strigosa* SCHREB. differs markedly from the other species of *Avena* contained in the Flora of Czechoslovakia (DOSTÁL et al. 1950). The main difference is in the lemma tips which are biaristulate when compared with the other species which have lemma tips bidenticulate (see Fig. 1). This conspicuous morphological character was previously applied in the taxonomic study by MAL'CEV (1930) who distinguished in the section *Euavena* GRISEB. the subsections *Aristulatae* and *Denticulatae*. The concept of *A. strigosa* SCHREB. s. ampl. by MAL'CEV (op. cit., p. 243—286) as well as earlier by THELLUNG (1911) was very broad indeed; altogether eight infraspecific taxa were recognized, of which six at the level of subspecies (subsp. *hirtula* (LAGASCA) MALZ., subsp. *strigosa* (SCHREB.) THELL., subsp. *barbata* (POTT) THELL., subsp. *wiestii* (STEUDEL) THELL., subsp. *vaviloviana* MALZ., and subsp. *abyssinica* (HOCHST.) THELL.), and two at the level of proles (prol. *brevis* (ROTH) THELL., and prol. *nuda* (L.) HAUSSKN.). Nowadays, many of these taxa are classified at the level of species, in some cases grouped even in different sections. In the recently published monograph by BAUM (1977), *A. strigosa* SCHREB. s. str. is placed in the section *Agraria* (BAUM 1975) together with *A. brevis* ROTH, *A. hispanica* ARD., and *A. nuda* L. This section suggests some relationships with the section *Tenuicarpa* (BAUM 1975) which comprises, however, all the species with spikelets disarticulating at maturity. On the contrary, all the species included in the section *Agraria* have a "cultivated base of spikelets" (see BAUM 1977 : 162), i.e. their florets in spikelets do not disarticulate at maturity, which indicates that these species were sown as cereal crops. Similar differences are well-known in other pairs or groups of *Avena* species, which found its expression as early as in the first classification by COSSON (1854) who distinguished two subsections in the genus *Avena: Sativae* and *Agrestes*. According to MAL'CEV's concept (1930, l.c.) *A. strigosa* SCHREB. s. ampl. comprises also some species of the BAUM's section *Tenuicarpa* at the level of subspecies, viz. *A. barbata* POTT ex LINK, *A. hirtula* LAG., *A. wiestii* STEUDEL. Moreover,

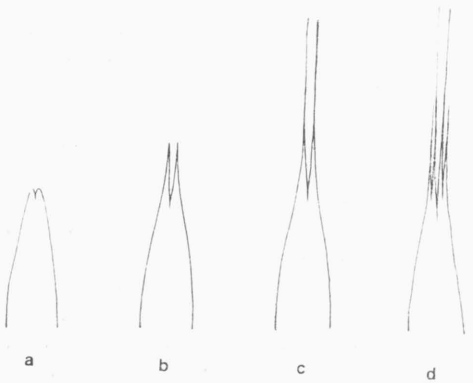

Fig. 1. — Various shapes of lemma tips in *Avena* spp. (only the prevailing forms schematically illustrated): a — bidenticulate, b — bisubulate, c — biaristulate, d — bisetulate-biaristulate.

A. abyssinica HOCHST. and *A. vaviloviana* (MALZ.) MORDV. were also placed here as subspecies, though BAUM (1977) placed both these species in his section *Ethiopica* (BAUM 1975). This broad species concept of MAL'CEV (1930) had, of course, some advantage for numerous taxa could be arranged into distinct types according to the supposed Vavilovian centres of evolution.

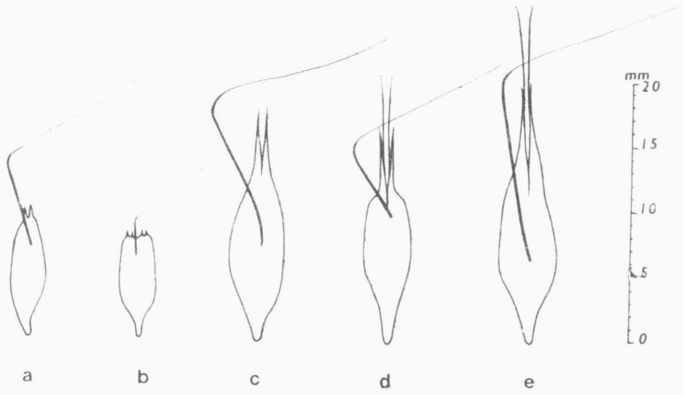

Fig. 2. — Species characters in the section *Agraria* BAUM (lemmas and awns of the first floret): a, b — *Avena brevis* (two different forms), c — *A. nuda*, d — *A. hispanica*, e — *A. strigosa*.

Another system of the species *A. strigosa* s. ampl. presented by MANSFELD (1959) and JANCHEN (1960) was applied in the "Exkursionsflora" by ROTHMALER et al. (1976 : 725). *A. nuda* L. em. MANSF. comprises here three subspecies: subsp. *nuda* (= *A. nuda* L.), subsp. *strigosa* (SCHREB.) JANCHEN (= *A. strigosa* SCHREB.), and subsp. *brevis* (ROTH) MANSF. (= *A. brevis* ROTH).

BAUM (1977), employing a whole complex of morphological as well as micromorphological characters distinguished all the last-mentioned taxa at the rank of species. Additionally, he re-established *A. hispanica* ARD., which is the closest related taxon to *A. strigosa* SCHREB., as a species. Among the characters for the discrimination of eat species, BAUM (op. cit.) stressed

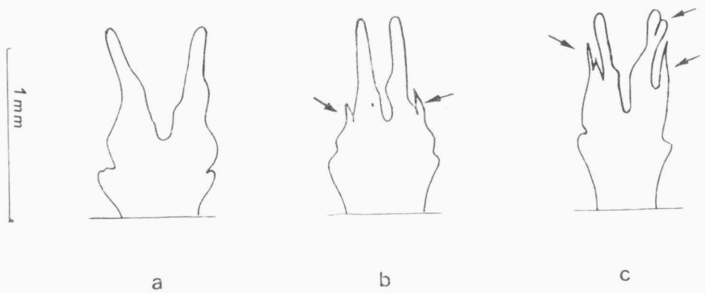

Fig. 3. — Various types of lodicule pairs in *Avena* spp.: a — fatua type, b — sativa type, c — strigosa type. Note the arrows indicating the typical side lobes and their position. (Wing-like appendages attached to the cylindrical lower part of the lodicule base are not relevant).

especially the following ones: lodicule type, epiblast type and size, a new definition of the components of lemma tip (for further see Fig. 1), place of insertion of the awn and vestiture of lemma below the insertion of the awn, and among the characters not relevant to this paper, e.g. shape of the scar and relative size of periphery ring (at disarticulating species), etc. For the discrimination of related species in the section *Agraria* BAUM, see Tab. 1 and Figs. 2 and 3.

Nevertheless, LADIZINSKY and ZOHARY (1971) have recently again published the concept of one "biological species" *A. strigosa*. Here, it may be emphasized that all the species of the section *Agraria* are diploid (2n = 14), whereas the species of the section *Ethiopica* are tetraploid (2n = 28), and in the section *Tenuicarpa* diploids prevail, only *A. barbata* and some forms of *A. wiestii* being tetraploid. Crossings among the species of section *Agraria* can readily be made, whereas crossings between *A. strigosa* s. str. and *A. barbata* are somewhat difficult (cf. MAL'CEV 1930). It is worth mentioning that all species of the section *Avena* (as circumscribed by BAUM 1975), where among others *A. fatua*, *A. sativa*, and *A. sterilis* belong, are hexaploid (2n = 42).

GEOGRAPHICAL DISTRIBUTION, ITS HISTORICAL ASPECTS, AND ORIGIN OF *AVENA STRIGOSA*

The dot cartogram of the world distribution of section *Agraria*, published by BAUM (1977 : 162), demonstrates that the distribution area of this section is mainly Atlantic Europe and the Canary Islands, between 25° and 65° N. From the cartograms of individual species in BAUM (op. c.) it can be derived that localities of *A. strigosa* s. str. are accumulated in north-western Europe, while localities of *A. hispanica* are confined to the south-western Europe, essentially to Portugal, north-western Spain, and south-western France.

A. strigosa s. str. is reported from 18 countries; especially frequent occurrences are known from the United Kingdom, Belgium, northern and north-western France, western and north-western Federal Republic of Germany, Switzerland, Luxemburg, Denmark, and southern Sweden, followed by these countries: Portugal, Spain, Norway, Finland, German Democratic Republic, Czechoslovakia, Austria, Poland, Hungary, USSR (Lithuanian SSR, Latvian SSR, Russian SSR, Byelorussian SSR, Ukrainian SSR), and Corse (France). A detailed survey of the distribution in the individual districts in France is contained in the cartogram by BARRALIS (1961), and from Denmark in the cartogram by PETERSEN et ØDGAARD (see in BACHTHALER 1975). The distribution in Norway is referred to by KORSMO (1930), in Austria by JANCHEN (1960), and in Belgium by STRYCKERS et PATTOU (1963). MAL'CEV (1930) listed many localities from north-western USSR, ROŽEVIC in KELLER et al. (1934, 1 : 204) pointed out frequent occurrence on sandy soils of the Byelorussian SSR, whereas in the Ukrainian SSR *A. strigosa* was referred to as a rare plant in cultivated oats (see KLOKOV in VISJULINA et al. 1970 : 40).

In the past, *A. nuda* was also grown to a larger extent mainly in Germany, Belgium, and United Kingdom (MAL'CEV 1930, BAUM 1977), and probably to a small extent in Bohemia (BERCHTOLD et SEIDL 1836 : 177, ČELAKOVSKÝ 1868 : 40, MALOCH 1913 : 130), Moravia (OBORNY 1883 : 134, FORMÁNEK 1887 : 106), and in Slovakia (NEILREICH 1866, 2 : 18; SAGORSKI in SAGORSKI et SCHNEIDER 1891, 2 : 538). DOMIN cited in his manuscript (DOMIN et al. 1953) FLEISCHER's remark that *A. nuda* had empirically been sown not far from the town of Litomyšl in 1895, but without any good results. DOMIN (op. c.) summarized in his manuscript that *A. nuda* was sown in Bohemia very rarely and noted also some ephemerous occurrences on arable land. *A. brevis* was once cultivated in western Europe and also introduced to some parts of the Euro-Siberian region (MAL'CEV 1930, BAUM 1977). Some indications of its occurrence as a weed in

Tab. 1. — Main diacritic characters of the species in the Section *Agraria* Baum (compiled schematically according to Baum 1977)

	A. brevis	*A. nuda*	*A. hispanica*	*A. strigosa*
Height of plants	relatively low (40—70 cm)	relatively low (60—80 cm)	relatively tall (70—110 cm)	relatively tall (80—120 cm)
Shape of panicle	slightly flagged	slightly flagged	equilateral	equilateral
Length of spikelet (without awns)	short, 10—15 mm	long, 20—28 mm	short, 13—24 mm (variable in shape)	relatively short, 20—25 mm
Number of florets	(1)—2—3	3—6	2	2—3
Length of glumes and their state Lemma structure	10—16 mm nearly equal tough	20—22 mm slightly unequal resembling glumes	12—20 mm nearly equal tough	16—24 mm nearly equal tough
Lemma tips	shortly biaristulate-bisetulate to quadri-mucronate (or shortly biaristulate-bilobed)	biaristulate (with a short and weak aristula) to bisubulate	bisetulate-biaristulate	bisetulate-biaristulate (sometimes biaristulate only)
Vestiture of lemma	no macrohairs below the awn insertion (sometimes a few hairs only)	without macrohairs below the awn insertion	a few macrohairs around the awn insertion (but always absent below this insertion)	with macrohairs present or absent below the awn insertion
Place of insertion of the awn	just below the tip of lemma	awnless or awns inserted at about middle of lemma	between upper 1/3 to 1/4 of lemma (rarely close to middle of lemma)	at about lower third of lemma
Lodicule	fatua type, small (about 0.5 mm long), ± triangular, never bearing prickles	strigosa type or fatua type	fatua type, but often with hydathodes and apex obtuse	strigosa type and often bearing prickles

Note: All the species have epiblasts of "brevis type", 0.3 to 0.4 mm wide.

Czechoslovakia could be found at the beginning of the past century only (cf. ENDLICHER 1830 : 123, KOSTELETZKY 1837 : 92). In Austria, its weedy occurrence in the past was reported from northern Burgenland by PILL (see in JANCHEN 1960 : 834). Nowadays, *A. brevis* is only rarely cultivated and occurs as a weed mainly in the Azores, the Canaries, Madeira, and Portugal (cf. BAUM 1977 : 164, and see also in MAL'CEV 1930 : 264).

Both of these species were not native to Czechoslovakia as supposed by BAUM (1977) who quoted for *A. brevis* (p. 167) as well as for *A. nuda* (p. 182) the locality "Tabor Bohemia Sloupnice", legit FLEISCHER 1907 (PRC) et FLEISCHER 1909 (PRC), respectively. These herbarium labels were, however, headed "Hortus regiae academiae pro agricultura, Tábor-Bohemia", and as a rule contained a remark "colui in horto meo — Sloupnice, Fleischer". Evidently, such plants were not collected in a natural site, but they were introduced into the botanical garden of the Royal Czech Academy of Agriculture in Tábor (southern Bohemia)[1]) by professor Bubák and presumably cultivated also in some other gardens by Czech amateur botanists; among them vicar Fleischer in Sloupnice near Litomyšl (eastern Bohemia) played an important role. Similarly, various agricultural plants were cultivated by prof. Laus in the botanical garden of the Teachers' College in Olomouc (Moravia), and designated on the labels of herbarium specimens "Hortus botanicus Olomucensis".

MAL'CEV (1930, Fig. 65 on p. 418, and p. 423) supposed that the centre of origin of *A. strigosa* (incl. prol. *brevis* and prol. *nuda*, as well as the whole subsection *Aristulatae*) should be located in the north-western Pyrenees or, more generally, in the Atlantic Iberian peninsula, owing to the great diversity of taxa revealed here (see also BAUM 1977 : 162). On the contrary, *Avena* species of MAL'CEV's section *Denticulatae*, where among others *A. fatua* and *A. sativa* belong, are mainly of Central Asiatic origin. According to MAL'CEV (op. c.), the wild-growing *A. hirtula* LAG. is supposed to be an ancestor of *A. strigosa* s. str., though other opinions ascribe this role to another wild-growing species, viz. *A. barbata* POTT ex LINK (HEGI et ZIMMERMANN 1936, BROUWER 1972); both species belong to BAUM's section *Tenuicarpa*.

Archeological findings of oat grains in lake dwellings in Switzerland (HEER 1866) belong presumably to the species *A. strigosa* as demonstrated by MAL'CEV (1930 : 416—423, and 499—500) and SINSKAJA (1969 : 392). According to these scientists and WERTH (sec. SINSKAJA, l.c.), the grains of *A. strigosa* are smaller and their lower end is pointed, so that they could be readily discriminated from *A. fatua* or *A. sativa*. The findings of *A. strigosa* are dated to the Bronze Age (i.e. ca. 2000 to 700 BC), whereas the remains of *A. fatua*, and partly of *A. sativa*, from various findings in Central Europe, could chiefly be referred to the Early Iron Age, especially to its Hallstadt period (i.e. ca. 700 to 400 BC). These facts support the contention that *A. strigosa* had been cultivated in Central Europe earlier than *A. sativa* and presumably had become also a component of the subspontaneous flora earlier than *A. fatua*. In the Early Iron Age, *A. sativa* as well as *A. fatua* occurred presumably as weeds in the cultivated cereals of that period, such as wheat and barley, and most probably they had been spontaneously introduced with these cereals (DOMIN 1945). Only in the course of the development of early medieval agriculture were the qualities of the cultivated oat (*A. sativa*) recognized by the ancient Slavs, and later also by German tribes.

MAL'CEV (1930 : 423—424, and 501) showed that *A. strigosa* (including prol. *brevis* and prol. *nuda*) belonged to the most ancient group of cultivated oats known already to the ancient Iberians and Basques, and partly to the Celts. He found in literature sources that *A. strigosa*,

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[1]) In the years 1900—1919, this Academy named "Královská česká akademie hospodářská" was in fact the only Czech Agricultural University with a botanical garden of considerable importance (for further information see ŠETELOVÁ et al. 1977 : 182).

especially in prol. *nuda*, had commonly been cultivated in England as late as in sixteenth century (according to RAJUS, MORISON and others — see in MAL'CEV, l.c.). BROUWER (1972 : 391) showed that *A. strigosa* was grown on sandy soils with a rough climate, especially in the mountains, until mid-20th century, and enumerated countries of western Europe from Portugal and Spain across southern and western France and Belgium to England, Scotland, Ireland, the Shetlands and Orkneys, followed by the plains of north-western Germany, some higher elevations in the Schwarzwald Mts., and in the Mühlviertel of Austria. Present-day sowings are, according to BROUWER (l.c.), rarely dispersed mainly in Spain, Portugal, and Wales (here under the name "Ceirch Llwyd"). The same is referred to by HUBBARD (1968) for mountain parts of Wales, Northern Scotland and Ireland. Some general indications on sowings of *A. strigosa* are contained in HEGI et ZIMMERMANN (1936), whereas KORSMO (1930 : 138) wrote about cultures in Denmark (Jütland). Nevertheless, as early as in the work of ZADE (1918 : 305) it was stated that *A. strigosa* (incl. *A. brevis* and *A. nuda*) was not worth sowing even on poor, light soils, and BROUWER (1972 : 391) wrote that "ihre Berechtigung als Kulturart zu gelten, hat die Art wegen der niedrigen Erträge weitgehend verloren".

With regard to the above account of the diminishing role of *A. strigosa* as a cultivated plant, there arises its present-day role as a weed on sandy, poor soils in western and central Europe. It has become a rare plant which can be found in sowings of cultivated oat and rye, exceptionally also in waste places (HEGI et ZIMMERMANN 1936, HUBBARD 1968). SCHUBERT et MAHN (1968 : 286—287), in their detailed synthesis, could state *A. strigosa* only in the weed community "*Teesdalio-Arnoseridetum*, Rasse v. *Setaria glauca*", which occurred on poor, sandy soils of the lowland "Dübener Heide" and of the "Fläming" in the German Democratic Republic. From the Gorce Mts. in Poland, KORNAŚ (1968) described a weed community "*Geranio-Silenetum gallicae*", in which *A. strigosa* occurred sporadically at elevations 660 to 760 m. Also WARCHOLIŃSKA (1974, see Tabs. 7 and 20) indicated *A. nuda* as a rare weed from the Piotrków Plain (central Poland); she found this species in "*Teesdalio-Arnoseridetum*" (sowings of cultivated oat) and in "*Spergulo-Lolietum remoti*" (sowings of flax). Unfortunately, the taxonomic concept of *A. nuda* was not clear enough from the literature cited, nost probably *A. strigosa* could be involved.

DISTRIBUTION OF *AVENA STRIGOSA* S. STR. IN CZECHOSLOVAKIA

The sources for the documentation of localities in the Czechoslovak territories were found (1) in the available herbarium specimens, (2) in all the available literature, above all of floristic character. For this purpose, the manuscript of DOMIN et al. (1953) containing data from various floristic papers and local floras also proved to be very useful. All specimens of the genus *Avena* L. s.l. deposited in twelve important Czechoslovak institutions were thoroughly revised and only records pertinent to *A. strigosa* were selected from the labels; the symbols of herbaria are quoted according to UJČÍK et HOUFEK (1970 : 3—4). The list of localities (see below) was compiled according to the phytogeographical regions and districts; for the territory of Bohemia and Moravia a new conception (Anon. 1977) and for the territory of Slovakia the earlier conception of DOSTÁL (adopted by FUTÁK in FUTÁK et DOMIN 1960) were used. In the particular phytogeographical districts the localities are arranged from west to east, and the localities of the same longitude from north to south. In some herbarium labels the year of collection and/or name of the collector are missing; such data have either been omitted or, if desirable, denoted with "s.a." (sine anno) and "s.auct." (sine auctore), respectively. Collectors are quoted mainly by the surname and

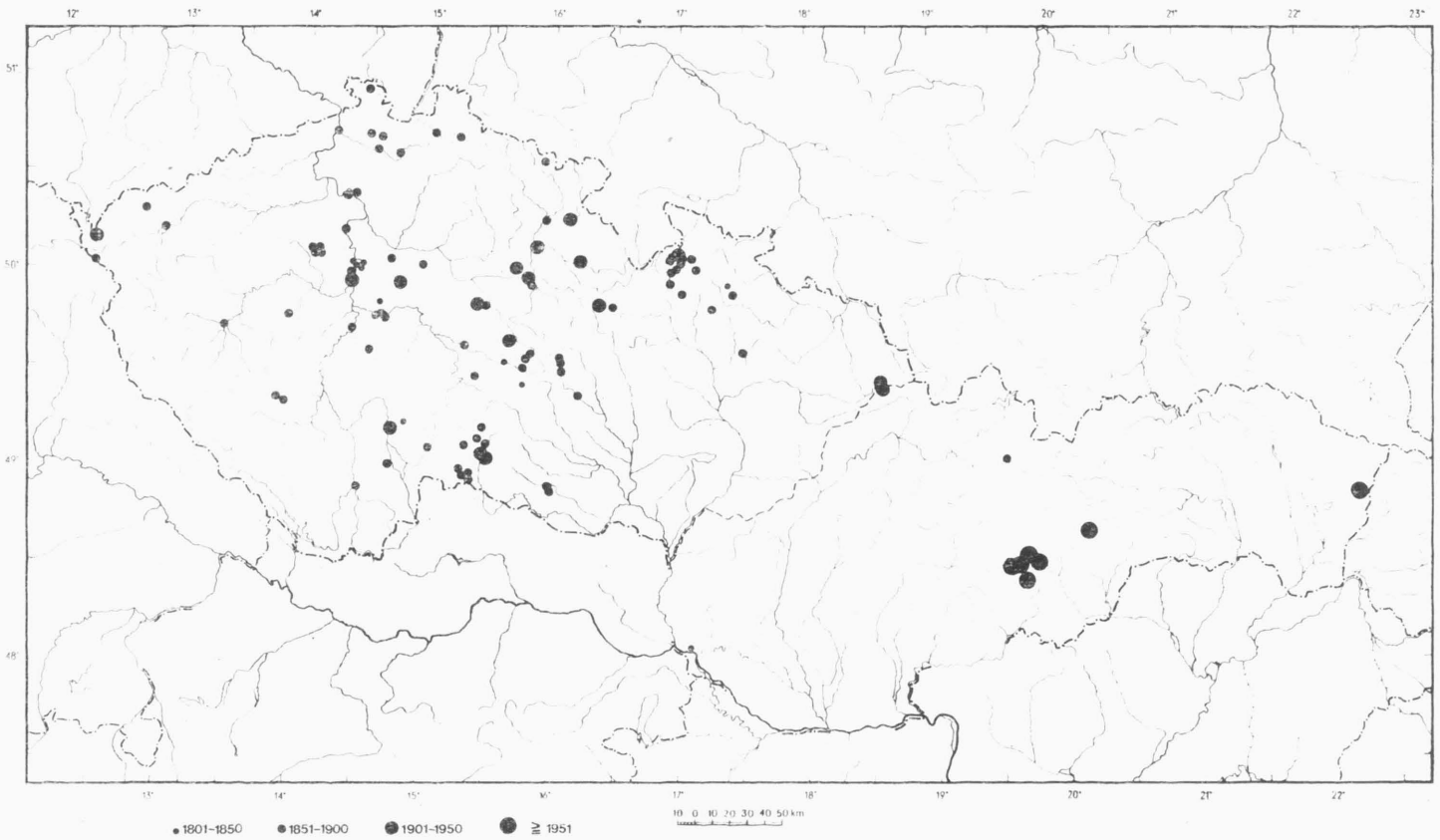

Fig. 4. — Distribution of *Avena strigosa* in Czechoslovakia represented by four fifty-year intervals.

abbreviations of the first name are used only to avoid possible confusion. The dot cartogram of distribution (see Fig. 4) was constructed on the basis of the following principles: (1) four fifty-year intervals from 1801 up to the present time are represented by different area of the particular "dot" (for further see explanation to Fig. 4), (2) if the same locality is indicated for different time intervals, only the more recent interval has been mapped, (3) in the case of accumulation of two or more localities in a small area, only localities distant at least 5 km from each other have been mapped. The following list comprises 108 localitie$_1$, of which 104 could be shown in the cartogram. The largest number of localities is concentrated in the period 1851—1900 (70.4 %), whereas from the year 1951 up to the present time only a small percent of localities could be stated (6.5 %).

List of localities

A. Bohemia and Moravia

Thermophyticum

Terezínská kotlina
Předonín (Lichtnecker in Čelakovský 1888 : 638)

Džbán
Libušín (Lichtnecker in Čelakovský 1891 : 9), Švermov-Motyčín (ibidem), Kladno (ibid.), Kladno: prope fodinam carboneam Amalia dictam (Lichtnecker et Wildt 1889, BRNM).

Středočeská tabule
Veltrusy (Polák 1878, PRC et Velenovský 1880, PRC), Štětí (Lichtnecker in Čelakovský 1888 : 638).

Český kras
Praha-Hlubočepy: in valle Sv. Prokop dicta (Opiz in Čelakovský 1868 : 40), Praha-Velká Chuchle (Čelakovský 1883 : 699 et Domin 1901, PRC).

Dolní Povltaví
Praha-Veleslavín (Opiz 1850, PR; etiam in Čelakovský 1868 : 40 et Čelakovský 1870 : 37).

Pražská plošina
Praha (Opiz 1847, PR), Praha (J. N. Bayer s. a., PR), Praha-Libeň (Opiz 1849, PR), Praha: haud procul ab urbe (F. I. Tausch s.a., PRC), Praha: in arvis ad urbem (Anonymus s.a., PRC), Nehvizdy (Velenovský in Čelakovský 1883 : 699).

Střední Polabí
Poříčany (E. Binder 1893, PRC et 1900, CB).

Východní Polabí
Bohdaneč (Vlček et Prokeš 1909 : 34; etiam in Hadač J. et Hadač E. 1948 : 58), Pardubice: in ruderatis, loco dicto Bubeneč (Hadač J. et Hadač E. 1937, publ. 1948 : 58), Pardubice: in agro haud procul a declivibus Nemošická stráň dictis (Košťál et Jahn in Čelakovský 1889 : 505; etiam in Hadač J. et Hadač E. 1948 : 58), Pardubice-Nemošice (Vodák in Hadač J. et Hadač E. 1948 : 58), Hradec Králové: in vicinitate oppidi (Kousal s.a., PR), Jaroměř: "in graminosis ad oppidum"[2]) (Fleischer 1881, PR; etiam in Čelakovský 1883 : 699), N. Město n. Met.: inter segetes in vicin. opp. (Vodák 1906, ms. sec. Domin et al. 1953 ms.).

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[2]) Author's authentic indication is cited in inverted commas.

Mesophyticum

Smrčiny
Vojtanov: in agris (Schleicher 1914, PRC), Wies [vicus extinctus] (Dalla Torre 1878 : 16; etiam Čelakovský 1883 : 699).

Horní Poohří
Karlovy Vary-Rybáře (Glückselig in Čelakovský 1868 : 40 et Ortmann in Čelakovský 1883 : 699).

Plzeňská pahorkatina
Plzeň (Anonymus in Herb. P. Hora s.a., PRC).

Podbrdsko
Hořovice (Schlechtendal in Čelakovský 1883 : 699).

Horaždovická pahorkatina
Vrbno: ager Avenae sativae (Velenovský 1879, PRC), Čekanice: in agro A. sativae copiose (Velenovský in Čelakovský 1883 : 699).

Budějovická pánev
České Budějovice: in vicin. opp. (Jechl s.a., BRNU, PR et PRC; etiam in Čelakovský 1868 : 40).

Třeboňská pánev
Soběslav: in horto scholae publicae (K. Stejskal 1908, PRC), Lomnice n. Luž.: ager A. sativae (Weidmann 1882, PRC; 1883, BRA; 1884, BRA et BRNM; 1886, PR), Tučapy: inter segetes ad pagum (Berchtold 1808, PRC et s.a. BRNU; etiam in Čelakovský 1868 : 40; vide etiam in Berchtold et Seidl 1836 : 178 sub "circulus Taborensis").

Střední Povltaví
Hněvšín: inter segetes supra flum. Vltava (Velenovský 1883, PR; etiam in Čelakovský 1886 : 7), Týnec n. Sáz. (Velenovský in Čelakovský 1888 : 638, vide sub Týnice n. Sáz.), Pecerady (Vodák in Čelakovský 1891 : 9), Bukovany (ibid.), Ledeč n. Sáz. (ibid.).

Votická pahorkatina
Vojkov: in agro Avenae orientalis copiose (Drtina in Čelakovský 1886 : 7).

Verneřické středohoří
Děčín (Malínský in Čelakovský 1868 : 40).

Šluknovská pahorkatina
Šluknov: ager A. sativae (Karl s.a., PR et PRC; etiam in Čelakovský 1868 : 40).

Lužická kotlina
Liberec: in agris ad opp. (C. T. [i.e. Tocl] s.a., PR; Tausch in Čelakovský 1868 : 40).

Lužické hory
Kamenický Šenov (Handschke in Čelakovský 1886 : 7).

Podještědí
Česká Lípa: in agro A. sativae dispersim (C. Mell s.a., PRC), Nový Bor (E. Hackel 1879, PR; etiam in Čelakovský 1883 : 699), Mimoň (Šouta in Čelakovský 1868 : 40).

Orlické opuky
Častolovice (Anonymus s.a., HR).

Litomyšlská pánev
Sloupnice: "in agro ad vicum copiose cum A. sativa, sed unico loco" (Fleischer 1884, BRA, BRNU et PRC); "in agris cum A. sativa ad Sloupnice, unico loco sed frequentissima" (Fleischer in Herb. Bubela 1884, BRNU); "cum A. sativa ad Sloupnice" (Fleischer 1895, BRA, BRNU et OLM); "colui in horto meo" (Fleischer, "Hortus regiae academiae pro agricultura, Tábor-Bohemia", 1907, BRNU et OLM; 1927, PRC).

Českomoravské mezihoří
Čes. Třebová (Čelakovský 1883 : 699).

Říčanská plošina
Štiřín (Sýkora in Berchtold et Seidl 1836 : 178; etiam in Čelakovský 1868 : 40), Žernovka [probabiliter][3]): in agris ad pagum cum speciebus *Arnoseris minima* et *Hypochoeris glabra* (Domin 1904 : 63).

Kutnohorská pahorkatina
Čáslav: ager A. sativae (Lukeš 1891, PR; Wilhelm 1906, PRC), Žleby: ad peripheriam occid. opp., loco dicto "Sv. Anna" (Opiz in Čelakovský 1868 : 40, vide sub "Sv. Anna čáslavská").

Hornosázavská pahorkatina
Havlíčkův Brod (Opiz 1822 : 266), Chotěboř: ager A. sativae loco dicto Sv. Anna (J. N. Bayer 1907, PR), Přibyslav: ager A. sativae (Vitoušek 1895, BRNU), M. Losenice: ager A. sativae (ibid.), Vepřová: ager A. sativae (ibid.).

Českomoravská vrchovina
Jindř. Hradec: ager in vicin. opp. loco dicto Sv. Jakub (Beneš 1876, PR), Humpolec: in agris A. sativae in vicin. opp. (Bezděk 1893, PR), Studená (Formánek 1887 : 106; etiam in Podpěra 1925 : 602), Matějovec (Oborny 1881, PRC et Oborny 1883 : 134, vide sub "Modes"; etiam in Formánek, l.c. et in Podpěra, l.c.), Stálkov (Oborny 1883 : 134; etiam in Formánek, l.c. et Podpěra, l.c.), Nová Ves, pagus situ septentr. ab oppido Slavonice (Oborny 1880, BRNU), Slavonice (Oborny 1883 : 134; etiam in Formánek, l.c. et Podpěra, l.c.), Růžená (ibid.), Telč (Formánek, l.c. et Podpěra, l.c.), Slaviboř: in agro A. sativae copiose (Teuber 1906, BRNM), Černíč: in agro A. sativae copiose (ibid.), Polná (Opiz 1822 : 266), Strážek (Formánek 1887 : 106, vide sub "Stražkov"; etiam in Podpěra 1925 : 602).

Moravské podhůří Vysočiny
Jevišovice: inter segetes (Oborny 1873, BRNU et PRC; etiam in Oborny 1883 : 134, Formánek 1887 : 106 et Podpěra 1925 : 602), Bojanovice (Oborny 1883 : 134; etiam in Formánek l.c. et Podpěra l.c.).

Hanušovicko-rychlebská vrchovina
Chrastice (Formánek 1887 : 106; etiam in Podpěra 1925 : 602), Staré Město (Oborny 1883 : 134, etiam in Formánek l.c. et Podpěra l.c.), Hanušovice (Formánek l.c. et Podpěra l.c.), Hanušovice et Zábřeh na Mor.: inter opp. in valle flum. Morava (Oborny l.c.; etiam in Formánek l.c. et Podpěra l.c.), Hajmrlov (Formánek l.c. et Podpěra l.c.), Pusté Žibřidovice (ibid.), Šumperk: ager A. sativae (J. Paul 1862, PRC; Paul in Oborny l.c., etiam in Formánek l. c. et Podpěra l.c.), Branná: inter segetes (Oborny 1873, PRC; Oborny 1883 : 134, vide sub "Goldenstein"; etiam in Formánek l.c. et Podpěra l.c., vide sub "Kolštýn"; Laus 1934, PRC), Alojzov (Formánek l.c. et Podpěra l.c.), in valle fluminis Branná (Oborny l.c., Formánek l.c. et Podpěra l.c.), Kouty n. Desnou (Formánek l.c. et Podpěra l.c.).

Jesenické podhůří
Rýmařov (Formánek 1887 : 106; etiam in Podpěra 1925 : 602), Velká Střelná [vicus extinctus] (Formánek l.c. et Podpěra l.c.).

Oreophyticum

Krušné hory
Nejdek: ad viam publicam pr. opp. (Schiffner 1882, PRC).

Jihlavské vrchy
Řásná (Formánek 1887 : 106; etiam in Podpěra 1925 : 602).

Žďárské vrchy
Fryšava (Formánek 1887 : 106; etiam in Podpěra 1925 : 602), Tři Studně (ibid.), N. Město na Mor. (ibid.).

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[3]) Domin (1904 : 63) described the locality as "Feldern bei 'Žemlovka' unweit von Říčan". However, a village of this name exists (and existed) neither in the environs of the town Říčany nor elsewhere in Czechoslovakia (cf. Collectivum 1978).

Jizerské hory
Lučany n. Nisou (HANDSCHKE in ČELAKOVSKÝ 1886 : 7).

Krkonoše
Rýchory: gradus submontanus et montanus in lato vicin. pagi (PAX 1883 : 447).

Hrubý Jeseník
Josefová (OBORNY 1883 : 134; etiam in FORMÁNEK 1887 : 106 et PODPĚRA 1925 : 602), montes Jeseníky: locatio ambigua, gradus submontanus et montanus, inter segetes et etiam culta (MAYER 1831, PRC; MAYER s.a., BRNM; ROHRER et MAYER 1835 : 21).

Moravskoslezské Beskydy
Locis dictis „Bílý Kříž": in agro ad cotam 942 prope limites territorii Slovakiae (H. ZAVŘEL 1946, BRNM).

B. Slovakia

Pannonicum

Podunajská nížina
Bratislava: "inter segetes, ad sepes et vias passim" (ENDLICHER 1830 : 123).

Carpathicum occidentale

Slovenské rudohorie
Detvianska Huta (KÜHN 1972 : 362), Látky (ibid.), Poljanky (ibid.), Málinec: inter pagos Málinec et Hámor (KÜHN et al. 1976 : 299 et 343—344), Močiare (ibid.), Muránska Zdychava (ibid.).

Vihorlat
Hrabová Roztoka (KÜHN 1977, in litt.).

Liptovsko-spišská kotlina
Convexum Liptovská kotlina dictum: locatio ambigua, inter segetes et etiam culta (SAGORSKI in SAGORSKI et SCHNEIDER 1891, 2 : 538).

Západobeskydské Karpaty
Súľov: inter segetes prope viculum Súľov situ sept.-occid. a pago Turzovka, ca. 900 m, etiam culta cum A. sativa, copiose (H. ZAVŘEL 1946, BRA).

RESULTS DERIVED FROM THE DISTRIBUTION OF *AVENA STRIGOSA* IN CZECHOSLOVAKIA

The localities known hitherto in Bohemia and Moravia represent 90.8 % of the total number; the phytogeographical region *Mesophyticum* takes the greater proportion of this percent (59.3 %), whereas only a smaller proportion belongs to the phytogeographical regions *Thermophyticum* (22.2 %) and *Oreophyticum* (9.3 %). In Slovakia, only a small proportion of localities (9.2 %) could be stated, predominantly in the phytogeographical region *Carpathicum occidentale* (8.3 %). The accumulation of localities in the phytogeographical districts Českomoravská vrchovina (12 %) and Hanušovicko-rychlebská vrchovina (10.2 %) may be pointed out as quite typical. This pattern of distribution of *A. strigosa* in Czechoslovakia corresponds well with its original distribution in western Europe with atlantic or subatlantic climate.

Analysing the relationships to macro-climate in Czechoslovakia (see in VESECKÝ et al. 1958), it can be concluded that the greater part of the lo-

calities are confined to the moderately warm region (especially to the districts which are moderately humid, humid or very humid) within the isotherms of mean annual temperature 5 °C and 7 °C and within the isohyetes of total annual precipitations 650 mm and 900 (1200) mm.

As to the altitudinal range, the greatest part of the localities are situated between 500 and 800 m, which corresponds to the submontane belt (cf. HOLUB et JIRÁSEK 1967), and only a small part lies in the planar and montane belt. In lowland, localities can be found predominantly on sandy soils along the river Labe (e.g. Děčín, Předonín, Veltrusy, Bohdaneč), whereas the most elevated localities are situated in the Carpathian Mts. of Slovakia (Polianky up to 980 m, Súľov ca. 900 m), partly also in Bohemia (environs of the village Rýchory ca. 900—980 m, see in PAX 1883 : 447) and presumably in the Jeseníky Mts. in Moravia (ROHRER et MAYER 1835 : 21).

Concerning soil conditions (cf. HRAŠKO et al. 1973) the leading position is obviously held by brown forest soils of low base saturation developed on various substrates (granite, gneiss, phyllite or various schists), and partly by podzols and rhegosols (the latter soil type occurs in the lowland of the river Labe).

When compared with the map of agronomic production zones the area of dense localities of *A. strigosa* corresponds well to the potato zone and partly to the mountain production zone (cf. Anon. 1961).

Regarding the geobotanical map of Bohemia and Moravia (MORAVEC et NEUHÄUSL 1976) the following units of reconstructed natural vegetation may be enumerated among those which correspond the most: *Luzulo-Fagion* LOHMEYER et TX. 1954, *Fagion* LUQUET 1926 em. PAWLOWSKI 1928, and partly *Quercion robori-petreae* BR.-BL. 1932 p.p.

As shown above, *A. strigosa* was introduced into the territory of present-day Czechoslovakia presumably as a cultivated plant from western Europe as early as in the Bronze Age. It was evidently cultivated before the advent of the more profitable cultivated oat — *A. sativa*. Nevertheless, *A. strigosa* was cultivated for a relatively long period even after this change of cereals on sandy, poor soils and climatically hard conditions. Consequently, in these regions *A. strigosa* became repeatedly a wild growing plant, mostly a weed of spring cereals, chiefly of the cultivated oat — *A. sativa*. These facts can be supported by the following citations: „Zwischen dem Getreide auf Feldern . . ." (POHL 1809, 1 : 114); „Hochgesenke, im Gebirge angebaut" (A. MAYER 1831, PRC); „Unter dem Sommergetreide in gebirgigen Gegenden, in Gesenke allgemein, zuweilen auch für sich allein angebaut" (ROHRER et MAYER 1835 : 21); „In Sandfeldern unter dem Sommergetreide" (BERCHTOLD et SEIDL 1836 : 178); „Unter dem Sommergetreide, hie und da als ‚Sandhafer', ‚Purhafer' angebaut" (SCHLOSSER 1843 : 389); "In fields among cereals, especially among cultivated oat"[4]) (ČELAKOVSKÝ 1868 : 40 et 1870 : 37); „Auf Feldern, namentlich unter Hafer, stellenweise häufig, besonders auf kaltem Sandboden . . . Offenbar durch Getreidebau eingeführt, doch schon ganz eingebürgert" (OBORNY 1883 : 134); „Hier und da, besonders in der Liptau angebaut" (SAGORSKI in SAGORSKI et SCHNEIDER 1891, 2 : 538). Many of these statements were also included in the works of FORMÁNEK (1887 : 106), LAUS (1908 : 158), and PODPĚRA (1925 : 602), who wrote that A. strigosa "was cultivated in mountain parts of Moravia and Silesia in the past", . . . "it is evidently an archaeophyte, nowadays quite naturalized, in Moravia it would grow untill now relatively abundant in western Moravia, in the environs of the town Dačice . . ., and frequently also in the foothills of the Jeseníky Mts."

Regarding the crops, data on the occurrence in cultivated oat (*A. sativa*) prevail quite clearly, e.g. on the labels of the following herbarium specimens: PAUL 1862, PRC; POLÁK 1878, PRC; VELENOVSKÝ 1880, PRC; WEIDMANN 1883, BRA et al.; FLEISCHER 1884, BRNU et al.; LUKEŠ 1891, PR; BEZDĚK 1893, PR; BINDER 1893, PRC; VITOUŠEK 1895, BRNU; KARL s.a., PR; TEUBER 1906, BRNM; J. N. BAYER 1907, PR; LAUS 1934, PRC. Similar statements can be found

4) Here only quotations written in Czech have been translated into English.

in the literature, e.g. in ČELAKOVSKÝ 1888 : 638, VODÁK 1906 sec. DOMIN ms., etc. Very interesting information can be found on the label by H. ZAVŘEL, locality Súľov in the Beskydy Mts. (BRA, 1946): ". . . it will be grown in a mixture with cultivated oat". On the other hand, a different indication has recently been given from the Slovenské Rudohorie Mts. (KÜHN 1972 : 362): „Die Pflanze wird als minderwertig für Mensch und Vieh angesehen. Als selbständige Kultur kennt man sie nicht. Wenn ihr Anteil im Hafer zunimmt, wechselt man das Saatgut".

The following data are available concerning the abundance and frequency of *A. strigosa*: "passim" (ENDLICHER 1830 : 123), "copiose . . . sed loco unico" (FLEISCHER 1884, BRNU et al.), copiously (VELENOVSKÝ 1880, PRC; VELENOVSKÝ 1883 in ČELAKOVSKÝ 1883 : 699; ZAVŘEL 1946, BRA et BRNM), and on the contrary also „einzeln" (TEUBER 1906, BRNM), „sehr vereinzelt" (MELL s.a., PRC), etc.

Outside the arable land only few reports could be found, e.g. „. . . an Zäunen, Wegen und in Wäldern" [?! — Z. K.] (POHL 1809, 1 : 114), "ad sepes et vias" (ENDLICHER 1830 : 123), "in graminosis ad Jaroměř" (FLEISCHER 1881, PR), „. . . an der Plattauer Strasse bei Neudek" (SCHIFFNER 1882, PRC), "loca inculta ad Chuchle pr. Pragam" (DOMIN 1901, PRC), ruderal site below the place called "Bubeneč" in Pardubice (HADAČ J. et HADAČ E. 1948 : 58).

In conclusion, it must be emphasized that the author of this paper has not succeeded in finding *A. strigosa* in evidently "good" localities in Bohemia and Moravia in the course of the last ten years. On the contrary, some new localities were revealed in Slovakia not long ago (KÜHN et al. 1976, KÜHN 1977 in litt.). This was due to home-made seeds of cereals used for sowing in some parts of Slovakia until recently (cf. KÜHN et al. 1976), whereas in Bohemia and most parts of Moravia this habit was abandoned much earlier and cleaned seeds only were sown. This fact plays an important role in analysing the diminishing occurrence of *A. strigosa* in Czechoslovakia; here, it is evidently an old ergasiolipophyte (sensu THELLUNG in NAEGELI et THELLUNG 1905) whose mode of dissemination is chiefly speirochory (cf. HILBIG et al. 1962, KORNAŚ 1972). Caryopses of *A. strigosa* do not survive in the soil for they are not dormant as experimentally shown by BARRALIS (1965). Consequently, *A. strigosa* practically disappeared from the arable land of Bohemia and Moravia, and it is in process of extinction in Slovakia. The same situation exists e.g. in *Bromus secalinus* or *Lolium temulentum* that were placed together with *A. strigosa* in the same group called "*Lolium remotum group*" by HILBIG et al. (1962 : 441). *Bromus secalinus*, *Lolium temulentum* and *L. remotum* have recently been listed under the "critically threatened taxa" in Bohemia and Moravia (HOLUB et al. 1979 : 225—226). On the contrary, e.g. *Avena fatua* shows typical dormancy and a long-term viability of caryopses in the soil, which results in its persistence on arable land. Owing to this feature *A. fatua* became a serious and widely distributed weed throughout the whole temperate zone of the world.

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SOUHRN

Avena strigosa SCHREB. — oves hřebílkatý (DOSTÁL et al. 1950) či oves hubený (DOSTÁL 1954, 1958) — byl kdysi na území Československa pěstován a vyskytoval se též jako polní plevel, dnes se však stal mizejícím druhem zdejší flóry. Nejprve je uveden přehled různých taxonomických koncepcí druhu *A. strigosa*. V širším pojetí Mal'cevově (MAL'CEV 1930) zahrnoval druh 8 infraspecifických taxonů, z nichž 6 bylo klasifikováno na úrovni poddruhu (subspecies) a 2 na úrovni proles. Podle poslední monografie rodu oves od Bauma (BAUM 1977) je všech 8 taxonů klasifikováno na úrovni druhů, náležejících dokonce do tří nově definovaných sekcí. *A. strigosa* SCHREB. s. str. je zařazena do sekce *Agraria* BAUM spolu s těmito druhy: *A. brevis*

Roth, *A. nuda* L. a *A. hispanica* Ard. Tato sekce se vyznačuje především nerozpadavostí klásků, což je charakteristické pro kulturní druhy, kdežto některé další příbuzné druhy, vyznačující se rozpadavostí klásků, náleží již do sekce *Tenuicarpa* Baum (např. *A. hirtula* Lagasca, *A. barbata* Pott ex Link, *A. wiestii* Steudel). Rozlišování blízkých příbuzných druhů v sekci *Agraria* pomocí morfologických a mikromorfologických znaků, nově definovaných zejména Baumem, obsahuje Tab. 1 a Fig. 2 a 3. Ve známé příručce „Exkursionsflora" (Rothmaler et al. 1976) je aplikována taxonomická koncepce tří poddruhů v rámci druhu *A. nuda* L. em. Mansf.: (a) subsp. *nuda*, (b) subsp. *brevis* (Roth) Mansf., (c) subsp. *strigosa* (Schreb.) Janchen (= *A. strigosa* Schreb. s. str.).

Sekce *Agraria* Baum má optimum svého rozšíření v atlantické části evropského kontinentu a na Kanárských ostrovech mezi 25° a 65° s. š. *A. strigosa* s. str. je udávána z 18 zemí včetně Československa, převážně však ze západní Evropy, kde byla v minulosti také běžně pěstována na chudších půdách v oblastech drsnějšího klimatu. Zde se také vyskytovala a vyskytuje subspontánně na orné půdě i na pustých místech. Z archeologických nálezů, zejména ve švýcarských kolových stavbách vyplývá, že *A. strigosa* byla známa též ve střední Evropě již v době bronzové, tedy dříve než *A. sativa* a než *A. fatua*. Původ druhu *A. strigosa* s. str. je nutno hledat v atlantské části Pyrenejského poloostrova a jeho předkem je pravděpodobně planě rostoucí druh *A. hirtula* Lag. Příbuzné druhy *A. nuda* a *A. brevis* byly dříve rovněž pěstovány v západní Evropě, avšak v menším počtu zemí. Na území dnešního Československa neměly jejich kultury žádný význam a lokální subspontánní výskyty byly efemérní povahy.

Rozšíření *A. strigosa* s. str. v ČSSR je dokumentováno seznamem 108 lokalit, pocházejících jednak z údajů na schedách revidovaných herbářových položek a jednak z veškeré dostupné literatury. V bodovém kartogramu rozšíření (Fig. 4) bylo možno zobrazit 104 lokality, graficky rozlišené do 4 časových intervalů po 50 letech, počínaje od r. 1801. Nejvíce lokalit pochází z let 1851—1900 (70,4 %), kdežto po r. 1951 až doposud bylo zjištěno pouze 6,5 % lokalit. Pokud jde o územní členění, je naprostá většina lokalit situována v Čechách a na Moravě (90,8 %), ze Slovenska však pocházejí nejmladší lokality. Zvláště typické byly výskyty na Českomoravské vrchovině a v Hanušovicko-rychlebské vrchovině, udávané starší literaturou (Oborny 1883, Formánek 1887, Podpěra 1925). Na známých lokalitách v českých zemích se však dnes druh prakticky nevyskytuje. Většina dosud známých lokalit je vázána na klimatickou oblast mírně teplou a hnědé půdy oligobázické, převážně v submontánním stupni. Z fytogeografických oblastí převládá v českých zemích *Mesophyticum* (dle nového členění in Anonymus 1977) a na Slovensku *Carpathicum occidentale* a pokud jde o geobotanickou mapu Čech a Moravy, nejvíce lokalit se kryje s jednotkami *Luzulo-Fagion* a *Fagion*. Literární a herbářové údaje hovoří přesvědčivě též o pěstování *A. strigosa*, zejména v minulém století. Subspontánně se vyskytoval jako segetál zejména v ovsu setém a jako ruderál poměrně vzácně na pustých místech. Oves hřebílkatý se rozšiřuje převážně speirochorně. Vzhledem k tomu, že jeho obilky nemají dormanci, nemohou přetrvávat v orné půdě a chovají se podobně jako např. *Bromus secalinus*, *Lolium temulentum* či *L. remotum*. Na Slovensku, kde se v odlehlých hornatějších krajích používalo donedávna domácí osivo, se tak mohl oves hřebílkatý ještě udržet jako plevelná příměs, zejména v ovsu setém.

A. strigosa je v Československu starým ergasiolipofytem (tj. kulturním reliktem ve smyslu Thellungově in Naegeli et Thellung 1905) s biologickou vlastností dalšího omezeného šíření jakožto plevele nevyčištěným osivem (zejména v ovsu setém). Nemůže se proto stát žádným nebezpečným plevelem jako např. příbuzný druh *A. fatua*, šířící se nejen osivem a dalšími způsoby, ale vynikající zejména výraznou dormancí obilek a schopností jejich přežívání v orné půdě.

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